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UNITED STATES DEPARTMENT OF AGRICULTURE
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BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Project | Date | Author

TITLE

Information
on the
ROCKY MOUNTAIN SPOTTED FEVER TICK
(Dermacentor andersoni Stiles)

Submitted By The
Rocky Mountain Laboratory
Public Health Service
United States Federal Security Agency
Hamilton, Montana
April 9, 1952

Forest Insect Laboratory
Coeur d'Alene, Idaho
April 10, 1952

SUBJECT—

INDEX NO.—

U. S. GOVERNMENT PRINTING OFFICE 16—47272-1

Avoid Insect Bites!

Ask for

Whitmire's

TICKS OFF

"Insect Repellent Bomb for Humans"

Repels: Chiggers, Mosquitoes
Flies, Fleas, Ticks

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ADDRESS REPLY TO
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ROCKY MOUNTAIN LABORATORY
HAMILTON, MONTANA

FEDERAL SECURITY AGENCY
PUBLIC HEALTH SERVICE
NATIONAL INSTITUTES OF HEALTH

BUREAU OF
Entomology and Plant Quarantine
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★ APR 10 1952 ★
Coeur d'Alene, Ida.
Laboratory

April 9, 1952

Dr. James C. Evenden
Forest Insect Laboratory
Coeur d'Alene, Idaho

Dear Dr. Evenden:

Your letter of April 7 addressed to the Director has been referred to me for reply.

This Laboratory has not been engaged in tick control activities for a number of years and we usually refer requests for information on control measures to the Division of Insects Affecting Man and Animals, Bureau of Entomology and Plant Quarantine, which has done considerable work with the newer insecticides. We do receive their reports, however, and I am glad to pass along whatever information we have at hand that may be of value to you. Most of the Bureau's studies have been with ticks other than Dermacentor andersoni, but it seems likely that the area control methods that have been found to be effective for these species would be at least of some value in the control of D. andersoni in small areas.

Enclosed is an excerpt from a Bureau circular, E-454, dated Feb. 1946 and entitled "Combatting the American Dog Tick, Carrier of Rocky Mountain Spotted Fever in the Central and Eastern States." Another excerpt is from a small pamphlet issued by the Massachusetts Department of Public Health, 1950, entitled "Ridding your Back Yard of Ticks." I am also sending two of our circulars, one of which deals with the tick itself and the other with protection against spotted fever.

The matter of repellents has come to the fore in recent years and Dr. Brennan of our staff has prepared the enclosed circular dealing with an effective repellent and methods of application. I should mention also that recently an aerosol spray formulation called "TICKS-OFF" was placed on the market in drug stores in this region. We have not had any experience with it but according to the promotional literature it appears to be effective against ticks occurring in other parts of the country. It certainly is handy to use and if it is as effective as claimed it should be a useful adjunct when used under conditions such as those to which you refer.

Please let me know if we can be of any further assistance.

Sincerely yours,

Glen M. Kohls
Senior Sanitarian

GMK:ms
Enclosure

From Circular of Mass. Dept. Health:

.....

SIZING UP THE PROBLEM

These facts indicate that if the property owner is to make the greatest use of his control measures, he should find where the ticks are lurking and do his spraying particularly in that area. When ticks are numerous enough to be much of a nuisance, they can be picked up on drags. If a burlap bag or a small blanket is dragged along the top of tall grass or over bushes, ticks can be found clinging to the lower surface of the drag. A pause should be made every few feet to inspect the drag and pick off and count any ticks which are found. In this way the most important areas for spraying can be discovered.

SPRAYING D.D.T.

The method of controlling ticks is quite simple. The householder goes to the place where he buys his garden seeds and supplies and purchases 50% wettable D.D.T., usually in one pound packages.

One pound of the wettable D.D.T. is poured into an ordinary orchard hand-sprayer which usually holds 3 gallons of water. The tank is filled about three-quarters full of water, its top screwed down tightly and the mixture well shaken. If it takes more than five minutes to empty the tank, it should be shaken vigorously again every four or five minutes to make sure that the D.D.T. is evenly suspended. It does not dissolve.

This quantity of spray is then distributed on the grass and bushes of a half acre of area. This will be a rectangle of approximately 100 by 200 feet, or if sprayed 10 feet on each side of a road or path, it will cover approximately 1000 linear feet. If a smaller amount is applied to an area, it will probably be ineffective. Be sure to empty the tank on the estimated area.

If a smaller sprayer (6 quarts or more) is used, one-half pound of wettable D.D.T. should be mixed with three-quarters of a tank of water and an area of one-quarter acre (about 100 x 100 feet) covered with the spray.

If spraying is carried out as soon as the ticks become numerous in April or May, control may be obtained for the whole season. If ticks are noted to be prevalent again early in June or later, a second application may be necessary.

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From Circular E-454

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Many of the ticks in an infested area can be killed by applying spray or dust to the ground and vegetation. The most satisfactory material to use for this purpose is DDT, as it provides a high initial kill and a lasting residual action. It may be applied as a spray or as a dust, whichever is more convenient. By either method from 2 to 3 pounds of DDT per acre should be applied. A convenient dust to use is one containing 10 percent of DDT in pyrophyllite. At this concentration from 20 to 30 pounds of dust per acre would be used, which is sufficient to assure adequate coverage.

Sprays containing DDT in various formulations with different solvents and emulsifiers have been found satisfactory and it seems probable that any water-miscible preparation will be effective. The following preparations when used in 100 gallons of water per acre have given excellent results: (1) 2 1/2 pounds of technical DDT dissolved in 12 1/2 pints of soluble pine oil; (2) 2 1/2 pounds of technical DDT dissolved in 6 1/4 pints of xylene and 1 1/4 pints of Triton X-100 (an aralkyl polyether alcohol). The amount of spray needed to secure adequate coverage varies with the type of vegetation. If 100 gallons per acre is not convenient, the quantity of water used may be increased or decreased, but the amount of DDT used should remain between 2 and 3 pounds per acre. At this rate DDT will not injure vegetation, and most of the solvents and emulsifiers used in water-miscible commercial preparations will also be

harmless, but no assurance can be given that this will be true in every case. At this dosage an initial reduction in tick abundance of better than 90 percent may be expected, and the treated area should remain practically free of ticks for a month or more.

CAUTION: DDT is poisonous if taken by mouth, and to a lesser extent by contact. Oil solutions of DDT, particularly the more concentrated ones, should not be allowed to remain on the skin.

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Sta. Circular No. 5
Revised March, 1943

FEDERAL SECURITY AGENCY
ROCKY MOUNTAIN LABORATORY

PUBLIC HEALTH SERVICE HAMILTON, MONTANA

THE ROCKY MOUNTAIN SPOTTED FEVER TICK

Dermacentor andersoni Stiles

by

R. A. Cooley, Entomologist
United States Public Health Service
Rocky Mountain Laboratory
Hamilton, Montana

Geographical Distribution. The Rocky Mountain wood tick, commonly spoken of as the Rocky Mountain spotted fever tick, occurs in that regional portion of the western United States which includes the following states and parts of states: Washington (eastern half); Oregon (west to the Cascades and a few records from the northwest corner), Idaho, Montana (excepting the extreme northeastern corner); North Dakota (southwestern corner), South Dakota (western edge), Wyoming, Nebraska (western end), Colorado (western two-thirds), New Mexico (northern portion), Arizona (Northern portion), Utah, Nevada and California (northeastern portion and eastern slope of Sierras south to northern Inyo County: also a few records from the San Francisco Bay region). It also extends into Canada in British Columbia, Alberta, and southwestern Saskatchewan, but its northern limit is not known.

The Life-Cycle. There are 4 stages in the life-cycle of the tick: the adult, the egg, the larva and the nymph. The adult ticks, male and female, feed on the larger animals and mate on the host. The females become greatly distended with blood and turn grayish, while the males show little increase in size. When fully fed, in about 9 days, the females drop to the ground, seek a protected place and lay a mass of eggs numbering on an average some 6400. In about 36 days the eggs hatch into the larvae or "seeds" which seek host animals, and feed for about 3 to 6 days on the small mammals. The fully fed larvae drop from the animals, find covering on the ground and transform into the next stage, the nymph. The nymphs in turn seek hosts, their animals being the same as those used by the larvae, and after a feeding period of 3 to 10 days, drop off, find cover, and transform and emerge as adult ticks, thus completing the life cycle.

Animal Hosts. While some degree of preference in host animals is shown by the Rocky Mountain wood tick in its various stages, in general it may well be said that availability largely determines what host animals will be used.

(over)

The choice of large animals by the adult ticks and of small mammals by both the larvae and nymphs is rather well defined, although all three stages may feed on some of the larger rodents. Throughout the range of the tick the host animals of the adult ticks are very much the same and include the horse, ass, mule, cow, sheep, goat, elk, deer, bear, coyote, porcupine and jack rabbit among wild animals. The larvae and nymphs feed on nearly all of the small rodents and to a less degree on the smaller carnivorous mammals. Their hosts include, among others; ground squirrels of many kinds, the pine squirrel, woodchuck, mountain rat, chipmunk, various kinds of mice, jack, snowshoe and cottontail rabbits, weasels and martens. They occur rarely on ground-frequenting birds.

Compared with the other ticks of the genus Dermacentor in North America, the Rocky Mountain wood tick stands out as being a species which feeds readily on nearly all of the wild and domestic animals, though the Pacific coast tick, Dermacentor occidentalis, has somewhat similar habits in this respect.

Seasonal History. Two years are required for the normal life cycle. Both adults and nymphs pass the winter in hibernation and there are two strains of the tick existing parallel in nature. The strain that hibernates as adults comes out in the spring, feeds and lay eggs. The larvae from these eggs feed and transform to nymphs during the same season and these nymphs hibernate the next winter. The other strain which hibernates as nymphs comes out, feeds and transforms to adults before the next winter. While the above is the usual cycle, some adults are delayed in finding a host and if the hot, dry weather of early summer comes on before they feed, it is necessary for them to go down to the ground for shade and moisture and these aestivate through summer and hibernate through a second winter and appear again the following spring. This may even happen still another year if the tick fails to find a host during the second summer, thus prolonging the period of waiting for food to nearly three years. Again some adults emerging a little earlier than usual will feed as adults during the same summer and these naturally join the ranks of the other parallel strain.

The Tick Season. The "tick season", or that period during which the adult ticks attack both man and animals, begins early in the spring very soon after vegetation starts to grow. The degree of advancement in vegetation varies, of course, in different elevations, different latitudes, and in different years. In general, it may be said that the ticks come with the buttercups, The conditions of awakening spring, and the abundance of moisture in the spring are favorable for the ticks, and they are active and a menace until with higher temperatures and much less moisture they disappear in late June, though there is a gradual reduction in numbers from the maximum naumbers in April and May. In the higher mountains the ticks naturally make their first appearance somewhat later and because of the cooler temperatures and increased moisture, may be found in small numbers as late as the middle of July. In some years, occasional ticks are encountered in August and September, and under exceptional conditions, in the fall and winter.

FEDERAL SECURITY AGENCY
Public Health Service
National Institutes of Health
Microbiological Institute
Rocky Mountain Laboratory
Hamilton, Montana

Rocky Mountain Laboratory
Circular 10
Revised March 1949

ROCKY MOUNTAIN SPOTTED FEVER: PROPHYLAXIS

by

R. R. Parker, Director
Rocky Mountain Laboratory

Control of the tick carriers of Rocky Mountain spotted fever has not proved feasible except perhaps under highly localized and special conditions. There are therefore but two avenues for preventing infection with Rocky Mountain spotted fever: first, personal care; second, vaccination. Under personal care are included the avoidance of tick bites, the wearing of suitable clothing, and the early removal of any ticks which may become attached to the body.

Of course, the best method of avoiding infection is to stay away from known infected areas. This is not possible, however, for a large part of the population in many affected regions. Furthermore, any section in which a tick carrier is present is potentially dangerous, and each year cases are being reported from areas in which the disease was hitherto unsuspected of being endemic.

In regard to suitable clothing there is a point of first importance, namely, the wearing of apparel that will prevent ticks from attaching to or crawling up the legs. For this purpose high boots, leggings, puttees and socks that are worn over trouser legs are all of real value. The ticks, which usually transfer from vegetation to the clothing at a height of less than 18 inches from the ground, will then crawl up the outside surface of the clothing, and most of them can be seen and removed. Those that reach the back of the neck, as many do if not discovered, even if entrance through the clothing has been made at some lower point, will often be felt when they touch the skin or hairs on the neck. It is good practice when in dangerous country to pass the hand over the back of the neck occasionally to feel for ticks.

Ticks are far more likely to secure a hold on rough clothing than on clothing of smooth texture. Each type of clothing has its advantages, however. The progress of the tick is impeded by the nap of rough cloth, but fewer ticks secure a hold if the cloth is smooth.

Women who go into dangerous areas temporarily for camping or other purposes should, whenever feasible, wear men's attire similar to that suggested.

If one is continually in tick country, some ticks will reach the body in spite of all precautions. It is necessary, therefore, that the foregoing measures be supplemented by the examination of the body and the inside of the clothing. Ticks seldom attach at once, and, since they but rarely transfer infection until after they have fed for several hours, examinations made twice a day, at noon and on retiring, are usually sufficient. In particularly dangerous areas, however, more frequent examinations are indicated, or, at least, any local irritation should be investigated to determine the cause.

When one retires, all clothing should be removed. This is mentioned because of the common habit among campers and many persons working outdoors of wearing part of the day-time garments at night. Both the body and the clothing should be carefully examined, and the latter should be so placed that any undiscovered ticks are unlikely to crawl from it to the bed. Exceptional care should be used when two persons occupy the same bed. If an infected tick becomes detached from one and attaches to the other, infection of the latter may take place quickly because the virus has already been reactivated. Instances of double infections caused in this manner by a single tick are far from uncommon. In one known instance three persons were thus infected.

Those who are exposed for only a few hours or for part of a day would do well to make a complete change of clothing on reaching the home, and the removed clothing should be so cared for that any unobserved ticks will not be a danger to other members of the household or to other persons.

Clothing placed on the ground attracts ticks from some distance and should be carefully examined before being put on. Ticks will crawl to persons who remain in small circumscribed areas for shorter or longer periods, such as, for example, persons sitting or lying on the ground. Persons sleeping outdoors should use care in selecting a camp or bed site. In this connection, one should bear in mind that ticks are usually more numerous where small animals are abundant. Such places should be avoided. Within the range of the Rocky Mountain wood tick, one of the safest camping locations is in timber, particularly where low vegetation is scanty, but on the other hand, open areas in timber may be dangerous. In sagebrush country one should keep away from the sagebrush. Proximity to trails and old roads should be avoided. Particular care should be exercised by persons following trails, since ticks tend to congregate on the vegetation on each side or on the upper side of trails that cross slopes. Grassy strips in the middle of little-used roads and vegetation along roadsides are often heavily tick-infested.

If a tick is found attached to the body it is best to remove it immediately. This is desirable because every added moment of attachment increases the danger of contracting spotted fever or other tick-borne infection. Many practices have been employed for removal. However, the desired result is most easily and quickly accomplished by gently pulling the tick off with the fingers. So far as the two chief transmitting agents of spotted fever (Dermacentor andersoni, the Rocky Mountain wood tick, and D. variabilis, the American dog tick) are concerned, there is little ground for the idea that the mouth parts will thus be left in the wound, in spite of popular opinion to the contrary. However, there is a definite danger of breaking off the mouth parts of ticks which have a longer hypostome, such as, for example, Amblyomma americanum, which is sometimes responsible for transmitting spotted fever in parts of the South Central and South Atlantic States. Better the mouth parts, however, than spotted fever, tularemia, or some other equally unattractive infection.

When sterile instruments are at hand, ticks of any species may be removed easily by pulling the tick gently so as to make a tent of the skin surrounding the site of attachment and then slipping the point of a hypodermic needle or scalpel under the mouth parts. The instrument is then raised, thus removing the mouth parts with a minimum of tissue. However the tick is removed, iodine or some other agent for antisepsis should be applied to the site of the bite. A silver nitrate pencil, which can be purchased for ten cents at any drug store, is convenient for outdoor use.

There is as yet no material which can be recommended to the general public for application to the clothing or the body to prevent tick attachment. Recent studies have shown, however, that N-butylacetanilide applied to the clothing offers much promise as a tick repellent. It is expected that information on the availability and use of the compound can soon be published.

Two types of vaccine have been developed by the Public Health Service: one prepared from the tissues of infected ticks, the other from the yolk sacs of developing chick embryos. The tick-tissue type has been in use for over 20 years, the chick-embryo type for 8 years. These vaccines are given in three doses of 1 ml. each at 5- to 7-day intervals. Anaphylactic reactions are rare, but are more likely to be serious in the case of the chick-embryo type. This type should not be given to persons allergic to egg proteins.

These vaccines have definite immunizing value. The degree of protection conferred varies with the individual, the relative virulence of the infecting strain, the number of successive years that vaccine has been administered, and perhaps to some extent with the age of the person vaccinated. The duration of any consequential degree of protection probably seldom exceeds the year of vaccination, except under certain circumstances (see below), and immunization each year is the only safe procedure.

Most persons vaccinated only once and infected later the same season have sufficient protection to modify the course of infection and to insure recovery and more rapid convalescence. Individuals vaccinated two or more successive years and infected the same year as last vaccinated are, in general, better protected than persons vaccinated only one year, and the evidence suggests that some such persons carry a consequential degree of immunity into at least the next year following that of the last administration of vaccine. Full protection apparently is rather frequent against strains of relatively low virulence, but probably occurs only occasionally against strains of high virulence. It is possible that children are fully protected against the latter more frequently than adults.

If a person is infected during the immunization period, there is strong probability that the subsequent clinical course of the disease will be affected favorably even if the infecting strain is one of high virulence. Also, if a vaccinated person is tick bitten, there is evidence which suggests that 1 ml. of vaccine administered soon after tick attachment may similarly alter favorably the clinical course if the rickettsia of spotted fever was transmitted. This procedure is obviously only practical for persons who are bitten rarely. While it is not feasible for those who are bitten frequently, the latter can, if they wish, take a booster dose of 1 ml. some time during the tick season.

In 1949 the Public Health Service discontinued the manufacture of the chick-embryo type vaccine. This was in conformance with the basic policy of the Service not to engage in the manufacture of any vaccine which is available commercially. This type of Rocky Mountain spotted fever vaccine can be purchased from the Lederle Laboratories, Sharp and Dohme, and E. R. Squibb and Sons. However, the Rocky Mountain Laboratory is continuing to manufacture and distribute the tick-tissue type, but only in an amount sufficient for the immunization of persons allergic to egg proteins. Requests for this type of vaccine should be addressed to the Director, Rocky Mountain Laboratory, Hamilton, Montana or to the Director, Microbiological

Institute, N.I.H., Bethesda 14, Maryland, and should indicate the number of persons to be vaccinated and should specifically state that it is needed for vaccinating persons to whom the chick-embryo type cannot safely be administered.

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Parker, R. R.: Rocky Mountain spotted fever: Results of fifteen years' prophylactic vaccination. Am. J. Trop. Med. 21(3) 369-383, May 1941.

FEDERAL SECURITY AGENCY
Public Health Service
National Institutes of Health
Microbiological Institute
Rocky Mountain Laboratory
Hamilton, Montana

Rocky Mountain Laboratory
Circular 15
August 1949

THE USE OF N-BUTYLACETANILIDE AS A TICK REPELLENT

by

James M. Brennan, Entomologist

Laboratory and field tests made by the Rocky Mountain Laboratory with various synthetic organic compounds showed N-Butylacetanilide to be an exceptionally promising repellent against the lone-star tick, Amblyomma americanum, and the Rocky Mountain wood tick, Dermacentor andersoni. It has not been tested against other species. The evidence suggests that this compound is also a very effective chigger ("red bug") repellent and/or killing agent.

One treatment of medium to heavy weight clothing will give adequate protection up to 2 weeks against all stages of ticks.

Method of Application

It is essential that approximately 2 fluid ounces of butylacetanilide be uniformly distributed throughout the outer garments. Impregnation may be accomplished by either of the following methods:

1. Dissolve 2 ounces butylacetanilide in 2-1/2 to 3 pints of acetone. One shirt, one pair of trousers (medium weight cotton twill), and one pair of socks dipped in this solution will take up the entire volume. Wring, dry, keep rolled or folded until ready to wear.

2. Dip garments in a 5 percent emulsion of butylacetanilide in a 1 percent soap-water solution. Stir emulsion while dipping. Wring over dip container, dry, keep rolled or folded until ready to wear.

   To treat 10 sets of clothing: (a) dissolve about 1/4 to 1/2 pound soap chips or laundry soap in 4 quarts boiling water; add 10 quarts cool water; (b) mix 1-1/2 pints butylacetanilide with an equal amount of the soap solution, stirring until a creamy emulsion concentrate is obtained and then add this to the remainder of the soap solution.

General Practices and Precautions

1. Since no binding agent has been developed it is necessary to re-treat clothing after laundering.

2. If trousers are tucked in boots it is not necessary to treat socks.

3. Untreated underwear, at least shorts, should be worn with impregnated clothing.

4. Butylacetanilide should not come in contact with plastics, paints, or varnishes, since it has a solvent effect on these materials.

5. It is not recommended that butylacetanilide be applied directly to the skin after the manner of mosquito repellents. While the U. S. Food and Drug Administration has pronounced this compound safe for the purpose intended, it may be mildly irritating to sensitive skins. Also its effectiveness and persistence as a repellent are much greater when it is impregnated in clothing.

Availability

N-Butylacetanilide is prepared by the Dow Chemical Company, Midland, Michigan, U. S. A. While this material is not yet generally available, it is understood that steps are being taken to market the product at an early date. Further information may be obtained from the Dow Chemical Company.

References

Brennan, James M. 1947. Preliminary report on some organic materials as tick repellents and toxic agents. Public Health Reports 62: 1162-1165.

Brennan, James M. 1948. Field tests with tick repellents. Public Health Reports 63: 339-346.